the Weber-Fechner formula, if the wave-frequencies be made a function of the constant; (7) the relation of the spectral energy to the presentation time may also be approximately expressed in the Tröndle formula, the wave-frequency being made a function of the constant.—Wm. Crocker.

Breeding for disease resistance.—It has been a popular impression that newly produced disease resistant varieties will gradually lose their immunity in later generations. The idea was that such new varieties might sometimes become slightly infected; this short sojourn of the disease organism in the normally immune host would enable the former to adapt itself to the new conditions and gradually acquire virulence, until finally a new biologic form was developed to which the host in question was quite susceptible. Evans[8] carried the same idea further when he found that a cross between resistant and susceptible races of wheat produced a hybrid even more susceptible to rust than the susceptible parent. Furthermore, rust from the hybrid could now infect the immune parent. Such facts were very discouraging, since they indicated that the artificial breeding of resistant crop plants is rapidly overtaken by the natural breeding of new biologic forms of the disease organism.

Particularly acceptable, therefore, is the work of Stakman, Parker, and Piemeisel,[9] who find that wheats resistant to rust remain resistant regardless of the previous history of the rust; the gap between immune and susceptible varieties is not bridged by transitional varieties or by artificial hybrids. "Resistance is rather an hereditary character, which cannot be produced by the accumulation of fluctuating variations within a susceptible line, nor broken down by changes in the host or parasite." Acceptable as such a conclusion may be, both to commercial breeders and to academic geneticists, it is very questionable how widely it may be applied. It will be difficult, although not hopeless, to explain away much of the contrary evidence.—Merle C. Coulter.

Nature of monocotyledonous leaves.—Mrs. Arber[10] has presented the results of an anatomical investigation of the phyllode theory of the monocotyledonous leaf. According to DeCandolle, it is equivalent to the leaf-base and petiole of a dicotyledonous leaf, but Mrs. Arber believes that certain monocotyledonous leaves are still further reduced in that they are equivalent to leaf-bases only. In case the monocotyledonous leaf shows a distinction of petiole and blade, Henslow suggested that the blade is merely an expansion

[8] Evans, I. B. P., South African cereal rusts, with observations on the problem of breeding rust resistant wheats. Jour. Agric. Sci. 4:95–104. 1911.

[9] Stakman, E. C., Parker, John H., and Piemeisel, F. J., Can biologic forms of stem rust on wheat change rapidly enough to interfere with breeding for rust resistance? Jour. Agric. Research 14:111–123. *pls. 13–17.* 1918.

[10] Arber, Agnes, The phyllode theory of the monocotyledonous leaf, with special reference to anatomical evidence. Ann. Botany 32:465–501. *figs. 32.* 1918.

of the apical region of the phyllode and not homologous with the blade of a dicotyledonous leaf. Such a blade among monocotyledons Mrs. ARBER calls a "pseudo-lamina." Such theories have been devised to explain the parallel venation of monocotyledonous leaves. Attention is also called to GRAY'S suggestion that some gymnosperm leaves may be equivalent to petioles, and the further suggestion made that this may be applied specially to the Gnetales.

These views were tested by Mrs. ARBER in anatomical investigations, comparing scale-leaves, petioles, and phyllodes of dicotyledons with the leaves of monocotyledons, the conclusion being reached that the occurrence of inverted vascular bundles toward the adaxial face of a leaf may be an indication of "phyllodic morphology." Other indications of phyllodic anatomy are developed, and its systematic distribution shows that it does not occur with any frequency outside the Helobiae, Liliiflorae, and Farinosae. This distribution is taken to confirm the view that phyllodic anatomy is an ancient character, revealing the origin of the monocotyledonous leaf.—J. M. C.

Stomata.—REHFOUS[11] has published a detailed study of the stomata of many groups. The details are too numerous for citation, but some of the general conclusions may be indicated. He is convinced that stomata are of first importance in indicating phylogeny and relationships. Their structure he claims is very constant within a group, numerous examples of this being given. For example, the structure of the stomata of the Amentiferae shows that they are nearer the level of the dicotyledons than of the gymnosperms or pteridophytes. In the same way it is shown that the Polypodiaceae constitute a special group, and that the Osmundaceae, Gleicheniaceae, and Schizeaceae approach more nearly the higher plants. A close resemblance is found between the stomata of cycads and conifers, leading to the conclusion that these groups are of common origin. Numerous illustrations of claimed relationships within great groups are either confirmed or contradicted. Several new types of stomata are described, among which those of *Polypodium*, *Platycerium*, *Cycas*, and *Casuarina* may be cited. In connection with the last named genus it is pointed out that its stomata are related to those of certain monocytoledons, as the grasses and certain of the xerophytic Liliaceae. The contribution is a valuable assemblage of facts in reference to the structure of stomata, accompanied by clear illustrations. The conclusions drawn from these facts are open to discussion.—J. M. C.

Water conduction in trees and shrubs.—FARMER[12] has published the results of an investigation of the comparative efficiency of the wood as a water-conducting tissue in about 60 species of plants, chiefly trees and shrubs. The

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[11] REHFOUS, LAURENT, Étude sur les stomates. Univ. Genève, Inst. Bot. IX. no. 6. pp. 110. *figs. 125.* 1917.

[12] FARMER, J. BRETLAND, On the quantitative differences in the water-conductivity of the wood in trees and shrubs. Proc. Roy. Soc. B. **90**:218–250. 1918.